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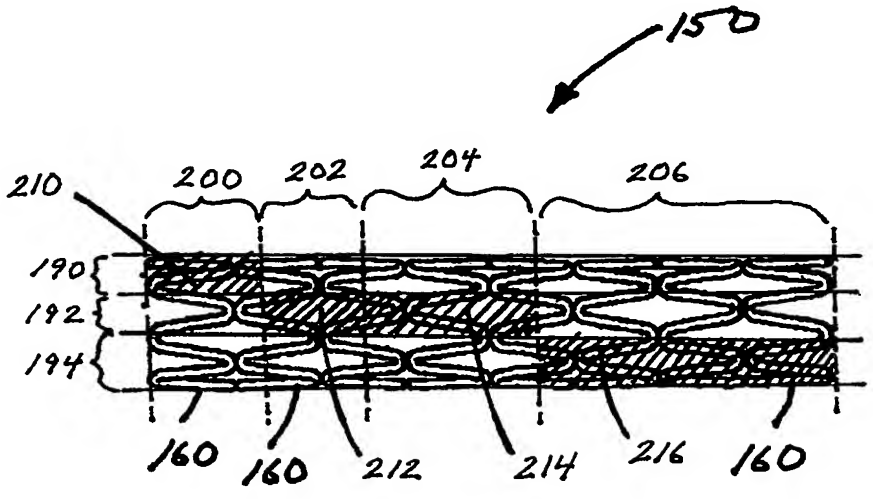
(54) Title: STENT WITH INTERMITTENT COATING



(57) Abstract: The stent with an intermittent coating of the present invention provides a coating having a plurality of discrete coating sections disposed on a stent, i.e., an intermittent coating. The individual coating sections can contain different drugs or therapeutic agents, can be made of different polymers, can be made with different solvents, or combinations thereof. The coating sections can be applied in patterns such as ring patterns, striped patterns, spotted patterns, or dot matrix patterns. In one embodiment, the regions can be large relative to the stent, such as a ring pattern including one therapeutic agent in the radial regions at the ends of a stent and a different therapeutic agent in the radial region in the middle. In another embodiment, the regions can be small relative to the stent, such as a dot matrix pattern with each grid region being a small point.

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AMENDED CLAIMS

[Received by the International Bureau on 23 April 2004 (23.04.2004); original claims 1-25 replaced by amended claims 1-25 (4 pages)]

1. A stent delivery system comprising:
a catheter;
a balloon operably attached to the catheter; and
a stent disposed on the balloon, the stent having a first region and a second region;
a first coating section, the first coating section disposed on the first region; and
a second coating section, the second coating section disposed on the second region;
wherein the first region and the second region are discrete.

2. The stent delivery system of claim 1 wherein the first coating section comprises a first polymer and the second coating section comprises a second polymer.

3. The stent delivery system of claim 2 wherein the first coating section includes a first therapeutic agent and the second coating section includes a second therapeutic agent.

4. The stent delivery system of claim 1 wherein the first coating section includes a therapeutic agent.

5. The stent delivery system of claim 1 wherein the first region and the second region form a pattern selected from the group consisting of ring patterns, striped patterns, spotted patterns, and dot matrix patterns.

6. A coated stent comprising:
a stent, the stent having a first region and a second region;
a first coating section, the first coating section disposed on the first region; and
a second coating section, the second coating section disposed on the second region;
wherein the first region and the second region are discrete.

7. The coated stent of claim 6 wherein the first coating section comprises a first polymer and the second coating section comprises a second polymer.

8. The coated stent of claim 7 wherein the first coating section includes a first therapeutic agent and the second coating section includes a second therapeutic agent

9. The coated stent of claim 6 wherein the first coating section includes a therapeutic agent.

10. The coated stent of claim 6 wherein the first region and the second region form a pattern selected from the group consisting of ring patterns, striped patterns, spotted patterns, and dot matrix patterns.

11. A method for producing a coated stent comprising:

providing a stent, the stent having a first region and a second region;

mixing a first polymer and first therapeutic agent with a first solvent to form a first polymer solution;

applying the first polymer solution to the first region to form a first coating section;

mixing a second polymer and second therapeutic agent with a second solvent to form a second polymer solution; and

applying the second polymer solution to the second region to form a second coating section.

12. The method of claim 11 wherein applying the first polymer solution and applying the second polymer solution further comprises applying the first polymer solution and applying the second polymer solution simultaneously.

13. The method of claim 11 further comprising curing the first polymer solution and curing the second polymer solution.

14. The method of claim 11 wherein applying the first polymer solution to the first region further comprises:

mounting the stent in a coating fixture; and

spraying the first polymer solution on the first region.

15. The method of claim 14 wherein the coating fixture is a computerized numerically controlled machine.

16. The method of claim 14 wherein spraying the first polymer solution on the first region further comprises spraying the first polymer solution by a spraying method selected from the group consisting of micro-spraying and inkjet spraying.

17. The method of claim 11 wherein applying the first polymer solution to the first region further comprises applying the first polymer solution by an application method selected from the group consisting of pad printing, inkjet printing, rolling, painting, spraying, micro-spraying, dipping, wiping, electrostatic deposition, vapor deposition, epitaxial growth, and combinations thereof.

18. A system for producing a coated stent comprising:

means for providing a stent, the stent having a first region and a second region;

means for mixing a first polymer and first therapeutic agent with a first solvent to form a first polymer solution;

means for applying the first polymer solution to the first region to form a first coating section; and

means for mixing a second polymer and second therapeutic agent with a second solvent to form a second polymer solution; and

means for applying the second polymer solution to the second region to form a second coating section.

19. The system of claim 18 wherein means for applying the first polymer solution and means for applying the second polymer solution further comprises means for applying the first polymer solution and the second polymer solution simultaneously.

20. The system of claim 18 further comprising means for curing the first polymer solution and means for curing the second polymer solution.

21. The system of claim 18 wherein means for applying the first polymer solution to the first region further comprises:

means for mounting the stent in a coating fixture; and

means for spraying the first polymer solution on the first region.

22. A coated stent comprising:

a stent, the stent having a discrete first region and a discrete second region;

a first polymer including a first therapeutic agent, the first polymer disposed on the discrete first region; and

a second polymer including a second therapeutic agent, the second polymer disposed on the discrete second region.

23. The coated stent of claim 22 wherein the discrete first region and the discrete second region are separated by a bare section.

24. The coated stent of claim 23 wherein the bare section extending between the discrete first region and the discrete second region for a distance of approximately 1 millimeter (0.03937 inches)

25. The coated stent of claim 24 wherein the bare section extending between the discrete first region and the discrete second region for a distance of approximately 0.025 millimeter (0.00098 inches).

CLAIMS

1. A stent delivery system comprising:
a catheter;
a balloon operably attached to the catheter; and
a stent disposed on the balloon, the stent having a first region and a second region;
a first coating section, the first coating section disposed on the first region; and
a second coating section, the second coating section disposed on the second region;
wherein the first region and the second region are discrete.

2. The stent delivery system of claim 1 wherein the first coating section comprises a first polymer and the second coating section comprises a second polymer.

3. The stent delivery system of claim 2 wherein the first coating section includes a first therapeutic agent and the second coating section includes a second therapeutic agent.

4. The stent delivery system of claim 1 wherein the first coating section includes a therapeutic agent.

5. The stent delivery system of claim 1 wherein the first region and the second region form a pattern selected from the group consisting of ring patterns, striped patterns, spotted patterns, and dot matrix patterns.

6. A coated stent comprising:
a stent, the stent having a first region and a second region;
a first coating section, the first coating section disposed on the first region; and
a second coating section, the second coating section disposed on the second region;
wherein the first region and the second region are discrete.

7. The coated stent of claim 6 wherein the first coating section comprises a first polymer and the second coating section comprises a second polymer.

8. The coated stent of claim 7 wherein the first coating section includes a first therapeutic agent and the second coating section includes a second therapeutic agent

9. The coated stent of claim 6 wherein the first coating section includes a therapeutic agent.

10. The coated stent of claim 6 wherein the first region and the second region form a pattern selected from the group consisting of ring patterns, striped patterns, spotted patterns, and dot matrix patterns.

11. A method for producing a coated stent comprising:

providing a stent, the stent having a first region and a second region;

mixing a first polymer and first therapeutic agent with a first solvent to form a first polymer solution;

applying the first polymer solution to the first region to form a first coating section;

mixing a second polymer and second therapeutic agent with a second solvent to form a second polymer solution; and

applying the second polymer solution to the second region to form a second coating section.

12. The method of claim 11 wherein applying the first polymer solution and applying the second polymer solution further comprises applying the first polymer solution and applying the second polymer solution simultaneously.

13. The method of claim 11 further comprising curing the first polymer solution and curing the second polymer solution.

14. The method of claim 11 wherein applying the first polymer solution to the first region further comprises:

mounting the stent in a coating fixture; and

spraying the first polymer solution on the first region.

15. The method of claim 14 wherein the coating fixture is a computerized numerically controlled machine.

16. The method of claim 14 wherein spraying the first polymer solution on the first region further comprises spraying the first polymer solution by a spraying method selected from the group consisting of micro-spraying and inkjet spraying.

17. The method of claim 11 wherein applying the first polymer solution to the first region further comprises applying the first polymer solution by an application method selected from the group consisting of pad printing, inkjet printing, rolling, painting, spraying, micro-spraying, dipping, wiping, electrostatic deposition, vapor deposition, epitaxial growth, and combinations thereof.

18. A system for producing a coated stent comprising:

means for providing a stent, the stent having a first region and a second region;

means for mixing a first polymer and first therapeutic agent with a first solvent to form a first polymer solution;

means for applying the first polymer solution to the first region to form a first coating section; and

means for mixing a second polymer and second therapeutic agent with a second solvent to form a second polymer solution; and

means for applying the second polymer solution to the second region to form a second coating section.

19. The system of claim 18 wherein means for applying the first polymer solution and means for applying the second polymer solution further comprises means for applying the first polymer solution and the second polymer solution simultaneously.

20. The system of claim 18 further comprising means for curing the first polymer solution and means for curing the second polymer solution.

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21. The system of claim 18 wherein means for applying the first polymer solution to the first region further comprises:

means for mounting the stent in a coating fixture; and

means for spraying the first polymer solution on the first region.

22. A coated stent comprising:

a stent, the stent having a discrete first region and a discrete second region;

a first polymer including a first therapeutic agent, the first polymer disposed on the discrete first region; and

a second polymer including a second therapeutic agent, the second polymer disposed on the discrete second region.

23. The coated stent of claim 22 wherein the discrete first region and the discrete second region are separated by a bare section.

24. The coated stent of claim 23 wherein the bare section extending between the discrete first region and the discrete second region for a distance of approximately 1 millimeter (0.03937 inches)

25. The coated stent of claim 24 wherein the bare section extending between the discrete first region and the discrete second region for a distance of approximately 0.025 millimeter (0.00098 inches).

INTERNATIONAL SEARCH REPORT

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A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 B05D1/00 A61F2/06 A61L31/10 A61L31/16 A61L27/14

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
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Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data, PAJ, EMBASE, BIOSIS

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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X	US 2002/051730 A1 (BODNAR STANKO ET AL) 2 May 2002 (2002-05-02) figures 23-26 paragraphs '0028!,'0029!,'0061!,'0063!,'0077!,'0078!, '0094!,'0099! paragraphs '0124!-'0126! ---	1-23
Y	paragraphs '0131!,'0168!	24,25

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
19 February 2004	26/02/2004

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Fayos, C

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

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